

BARNSTEAD|THERMOLYNE CORPORATION

# **MIRAK™ Hot Plates, Stirrers and Stirring Hot Plates**

## **OPERATION MANUAL AND PARTS LIST**

### ***SERIES 725, 726, 727, 728, 729, 730***

<b>Model #</b>	<b>Voltage</b>	<b>Description</b>
HP72620	240	7x7
HP72620-26	220-240	7x7
HP72624	100	7x7
HP72625	120	7x7
S72520	240	7x7
S72520-26	220-240	7x7
S72524	100	7x7
S72525	120	7x7
SP72720	240	7x7
SP72720-26	220-240	7x7
SP72724	100	7x7
SP72725	120	7x7
HP72930	240	12x12
HP72930-26	220-240	12x12
HP72934	100	12x12
HP72935	120	12x12
HP72935-60	120	12x12
HP72938	208	12x12
S72830	240	12x12
S72830-26	220-240	12x12
S72834	100	12x12
S72835	120	12x12
SP73030	240	12x12
SP73030-26	220-240	12x12
SP73034	100	12x12
SP73035	120	12x12
SP73035-60	120	12x12
SP73038	208	12x12

## IMPORTANT INFORMATION

This manual contains important operating and safety information. The user must carefully read and understand the contents of this manual prior to the use of this equipment.

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# Safety Information

Your Thermolyne MIRAK™ stirrer, hot plate, or stirring hot plate has been designed with function, reliability, and safety in mind. It is your responsibility to install it in conformance with local electrical codes.

## Alert Signals



### WARNING

Warnings alert you to a possibility of personal injury.



### CAUTION

Cautions alert you to a possibility of damage to the equipment.



### NOTE

Notes alert you to pertinent facts and conditions.

## Warnings

### WARNING

#### To avoid electrical shock, always:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.
2. Disconnect from power supply before servicing.

#### To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such materials.
2. Keep top surface clean. Use a non-abrasive cleaner. Alkali spills, hydrofluoric acid spills or phosphoric acid spills may damage top and lead to thermal failure. Unplug unit and remove spills promptly. Do not immerse unit for cleaning.
3. Replace the top immediately if damaged by etching, scratching or chipping. A damaged top can break in use.
4. Do not remove or modify grounded power plug. Use only properly grounded outlets to avoid shock hazard. Not rated for use in hazardous atmospheres.
5. Use caution when heating volatile materials; top surface and element can reach the "Flash Point Temperature" of many chemicals. These hot plates and stirring hot plates are not explosion proof. Fire or explosion may result. Unit contains components which may ignite such materials.
6. Use appropriate hand and eye protection when handling hazardous chemicals.
7. "Caution: Hot Surface. Avoid Contact." The hot plate will remain hot without any visual indication for some time after power has been removed.
8. Do not use in highly corrosive atmospheres; corrosive fumes and spill may damage top and internal components, creating shock hazard.
9. Refer servicing to qualified personnel.



### CAUTION

Space unit 12 inches away from combustible materials under any conditions.

Gross weight of items placed on top of Hot Plates should not exceed 25 lbs. on the 7" X 7" and 30 lbs. on the 12" X 12" models.

**Please note the following WARNINGS:**

## **WARNING**

**This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate pre-existing respiratory diseases.**

**Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possible carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).**

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the top plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers therefrom. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead|Thermolyne Corporation at **1-800-553-0039**.

## **WARNING**

**REFER SERVICING TO QUALIFIED PERSONNEL.**

# Introduction

Please read all the information in this manual before operating the unit.

Your Thermolyne MIRAK™ hot plate, stirrer or stirring hot plate is a general purpose heating and/or stirring plate designed for laboratory procedures requiring precise control of temperature and/or stirring speed. Each MIRAK model includes a digital display for monitoring actual temperature or stirring speed, and the stirring hot plate models have dual displays so temperature and stirring speed can be monitored simultaneously. The hot plate is capable of producing accurately controlled top plate temperatures from 40°C through 540°C on all 7" x 7" models and the 208 volt and 240 volt models of the 12" x 12" hot plates. (12" x 12" 100 volt and 120 volt models have a temperature range of 40°C to 370°C.) The temperature may be controlled at the plate surface by an internal Type K thermocouple sensor, or the solution temperature may be controlled by utilizing an accessory ungrounded Type K thermocouple probe. A 6" or 10" general purpose stainless steel immersion probe, or a chemical-resistant 7" solid Teflon® immersion probe may be ordered separately. The stirrer will accurately maintain stirring speeds from 60 rpm up to 1200 rpm. On stirring hot plate models, the accessory probe may also be utilized to display the actual temperature of heat-sensitive solutions during stirring-only functions. The 7" x 7" or 12" x 12" top plate on the MIRAK units is solid ceramic, and is suitable for use with glass or metal vessels.

Your MIRAK hot plate, stirrer or stirring hot plate may be used for general purpose heating applications and/or general laboratory mixing of solutions, including sample preparation, heating reagents, melting paraffin, warming resinous chemicals, content analysis, solvent evaporations, digestions, media preparation and sterilization, titrations, sand baths, and microscale chemistry applications.

## Unpacking

Remove your MIRAK hot plate, stirrer or stirring hot plate from the carton. Inspect to ensure that the unit has not been damaged during shipment. If the unit appears to have sustained shipping damage contact the distributor from whom you purchased this product or Barnstead/Thermolyne Customer Service at 800-553-0039. Remove the packaging from underneath the top plate by gently pulling the packaging material toward you.



### NOTE

A special 20-amp cord set is included on the CSA-approved models of the 12" x 12" 120 volt MIRAK hot plate and stirring hot plate (HP72935, SP73035). This 20-amp cordset can only be plugged into a non-standard 20-amp, 120 volt receptacle. If you do not have the appropriate receptacle, contact a qualified electrician for installation of a 20-amp 120 volt outlet.

**20-amp, 120 volt**

A 12" x 12" 120 volt MIRAK hot plate and stirring hot plate (HP72935-60, SP73035-60) is available with a standard 15-amp, 120 volt cordset. These models are not CSA-approved.

**15-amp, 120 volt**



# Installation



## WARNING

Use a properly grounded electrical outlet of correct voltage and current handling capacity.

Do not remove or modify grounded power plug. Use only properly grounded outlets to avoid shock hazard. Not rated for use in hazardous atmospheres.

Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such materials.

Do not use in highly corrosive atmospheres; corrosive fumes and spill may damage top and internal components, creating shock hazard.

Set the unit on a flat stable surface at least 12" away from combustible materials, and plug the cordset into a properly grounded electrical outlet of correct voltage and current handling capacity. Use your right hand to locate the ON/OFF power switch which is on the side, near the front right corner as you face the unit. Press the black ON/OFF power rocker switch into the ON position. The red LED display(s), and the green power light to the left of the display(s) should illuminate. The unit is ready for operation.



## NOTE

Some misalignment of the motor bearings in this product may have occurred during shipping. Prior to using this product, run the stirrer at maximum speed for ten minutes to realign the bearings.

# Principles of Operation

Each MIRAK unit utilizes the latest in microprocessor technology to deliver the most reliable, accurately controlled, ceramic top hot plate, stirrer and stirring hot plate on the market.

Your MIRAK hot plate or stirring hot plate has an electronic closed-loop feedback control which will accurately maintain temperature setpoints from 40°C through 370°C or 540°C, depending on the model. The top plate surface temperatures are calibrated and verified at the factory using the latest in infrared temperature measurement. The measurements are made with an infrared camera mounted approximately 26" above the top surface of the hot plate or stirring hot plate. If the temperature measurement of the ceramic top is made with measurement devices other than infrared, the error of the measuring technique may be greater than the error of the unit.

The MIRAK units use a Type K thermocouple for measuring both the top plate temperature, and the solution temperature when using the probe. Both top plate surface and probe temperature are measured with independent analog circuits. This provides a significant increase in reliability due to the redundancy of the circuit. Because of the dual sensors it is possible to heat certain types of metal vessels and sandbaths on the MIRAK without damaging the ceramic top. However, we recommend that you do not control the temperature with the probe when heating a metal vessel or a sandbath.

The electronic stirring speed control will maintain the speed setpoint when the unit is loaded at  $\pm 2$  RPM as displayed by the LED display on the unit. The motor in the MIRAK stirrers and stirring hot plates produces maximum stirring torque under normal laboratory load conditions, and is combined with a powerful magnet to provide exceptional magnetic coupling with a stirbar.

# Operation



## WARNING

Use caution when heating volatile materials; top surface and element can reach the "Flash Point Temperature" of many chemicals. These hot plates and stirring hot plates are not explosion proof. Fire or explosion may result. Unit contains components which may ignite such materials.

Use appropriate hand and eye protection when handling hazardous chemicals.

"Caution: Hot Surface. Avoid Contact." The hot plate will remain hot without any visual indication for some time after power has been removed.



## CAUTION

To avoid damage to the top plate or heating element, always keep a vessel filled with liquid on the top plate of a hot plate or stirring hot plate when the unit is heating or cooling.

## Removing the Clear Plastic Cover

Your MIRAK unit has a protective plastic cover over the front control panel. This plastic cover is designed to protect the control knobs and the display panel from spills, and should remain in place when the unit is being used. To use the knob(s) while the plastic cover is in place, spin the knob(s) from the bottom where the knob projects below the plastic cover. This plastic cover can be easily removed for cleaning by grasping the cover at each bottom corner and gently pulling the sides of the plastic cover away from the case while lifting the cover toward you. To replace the cover simply slide it back onto the case.

## The Power Switch

Your MIRAK unit has a separate ON/OFF power switch which is a black rocker switch located on the lower front corner of the right side as you're facing the unit. This separate power switch allows you to turn your MIRAK hot plate, stirrer or stirring hot plate on or off without disturbing your temperature and/or speed setting. Your last setpoint will be held in memory even if the unit is unplugged and will reappear on the display as soon as the unit is powered up again. Whenever the power is on, a green power light illuminates on the front control panel.

## Setting the Stirring Speed

Your MIRAK stirrer or stirring hot plate has an electronic feedback speed control which will maintain a precise speed setpoint from 60 rpm through 1200 rpm at  $\pm 2$  rpm. (Maximum speed is dependent on viscosity of the solution.) The MIRAK stirrers and stirring hot plates are equipped with a strong magnet and high torque motor which will draw a vortex in up to 1800 ml of water stirred in a 2 liter flask with a new 2" stir bar.

To set the speed, spin the SPEED CONTROL knob until your desired setting is indicated on the digital display. As you move the knob, the SET light next to the RPM display will illuminate. Turn the knob clockwise to increase the speed or counterclockwise to decrease the speed. The unit will not start to stir until you press the speed control knob. Once the unit begins stirring the display will register ACTUAL speed and the SET light will no longer be illuminated. To check your setpoint, move the knob counterclockwise one position. You will feel a click, the SET light will illuminate, and your setpoint will be displayed again for five seconds. After five seconds the display will automatically return to indicating actual speed and the SET light will go out. To stop the stirring action without changing your setpoint press the knob once. To resume stirring at the set speed, press the knob again.



If you want to ensure that the unit will not start to stir if the knob is inadvertently pressed, turn the speed control knob until the display indicates the word OFF.

## Stirring Speed Guide

Unit	Flask Size	Stirbar Size	Amount of Solution	Viscosity	Maximum Speed*
7" x 7" MIRAK	1 liter	2"	800 ml	water	1200 rpm
7" x 7" MIRAK	2 liter	2"	1800 ml	water	1200 rpm
7" x 7" MIRAK	1 liter	2"	1000 ml	Cooking oil	700 rpm
7" x 7" MIRAK	500 ml	2"	350 ml	30 weight motor oil	1100 rpm

\*Maximum speed obtained without the stir bar losing coupling with the magnet.

The 12" X 12" MIRAK stirrers and stirring hot plates will produce stirring speed results similar to those provided above for the 7" X 7" units. For speed stability and display accuracy please refer to the Operating Specifications on page 13.

## Setting the Temperature

Your MIRAK hot plate or stirring hot plate has an electronic closed-loop feedback control which will accurately maintain temperature setpoints from 40°C through 370°C or 540°C, depending on the model. An unloaded hot plate will heat to maximum temperature in just 8 minutes. A HOT light on the front panel will illuminate whenever the top surface temperature exceeds 50°C. The temperature may be controlled either at the top plate by the internal Type K thermocouple sensor, or in the solution using an accessory ungrounded Type K thermocouple probe. (A 6" or 10" stainless steel general purpose immersion probe, or a chemical-resistant 7" Teflon® immersion probe are available through your distributor, or by contacting Barnstead/Thermolyne, 800-553-0039). Your MIRAK hot plate, stirrer or stirring hot plate will accept any ungrounded Type K thermocouple probe, however the accuracy of probes other than the ones we've tested and specified may exceed the probe accuracy rating we've designated.

Your MIRAK hot plate or stirring hot plate will display the temperature in °C. The display will always indicate 'OFF' or your last setpoint, and the 'SET' light will be illuminated until you press the heat control knob to initiate operation. Once the heat control knob has been pressed the ACTUAL temperature of the top plate or the probe will be displayed, and the 'SET' light will no longer be illuminated. If you want to check your setpoint, you do not have to press the knob again, simply turn the knob counterclockwise one click. Your setpoint will be displayed for approximately five seconds until the display returns to indicating the actual temperature.



### NOTE

The temperature display will not indicate a temperature less than 40°C. If the actual temperature is less than 40°C, the word 'LO' will be indicated until the actual temperature reaches 40°C.

If you want to ensure that the unit will not heat if the knob is inadvertently pressed, turn the temperature control knob until the display indicates the word 'OFF'.

## Controlling Top Plate Temperature

Your MIRAK hot plate or stirring hot plate will control the top plate, and the display will indicate top plate temperature **WHENEVER THE PROBE IS NOT PLUGGED IN**. When the unit is displaying the top plate temperature the word **TOP** on the front panel will be illuminated.

## Controlling Solution Temperature

To control your solution temperature simply plug an ungrounded Type K thermocouple probe into the probe receptacle located on the back of the unit, and place the probe in your solution. The display will indicate the actual temperature of the solution as measured by the probe, and the word **PROBE** on the front panel will be illuminated.



### NOTE

The top plate temperature will be higher than your solution temperature.

The solution probe offers more exact temperature control than regulating the top plate by the internal sensor. If you need to maintain a precise setpoint we recommend using a probe to control the solution temperature instead of controlling the top plate temperature.

When using a probe with your MIRAK hot plate or stirring hot plate it is recommended that you use a clamp on a support rod to hold the probe in your solution.

To ensure accurate probe readings, as much of the probe sheath as possible should be immersed in your solution. If the probe is plugged into your hot plate or stirring hot plate while the heat control is operating but is not in solution, the temperature display will continue to indicate an ambient temperature. Because the set point cannot be reached the element will continue to supply heat to the top plate, and the maximum top plate temperature of 540°C may be reached.



### WARNING

If the probe is plugged into your stirring hot plate while the heat control is operating but is not in solution, the temperature display will continue to indicate an ambient temperature. Because the setpoint cannot be reached, the element will continue to supply heat to the top plate, and the maximum top plate temperature of 540°C may be reached. Any type K thermocouple probe used must be an ungrounded type.



### NOTE

The top plate temperature will not exceed the 540°C maximum.

To obtain an accurate reading when you are using the probe and stirring your solution, make sure the probe is immersed in the liquid and is not located in air in the center of the stirring vortex. Drafts and other temperature fluctuations will affect temperature accuracy.

## Calibrating the Probe Temperature Input



### NOTE

The following procedure can be performed only on units with serial numbers greater than the following:

7" Hot Plates .... 726931000000

7" Stirring Hot Plates ... 727931000000

12" Hot Plates ...729931000000

12" Stirring Hot Plates ... 730931000000

To verify the temperature reading of the probe, insert a calibrated thermometer into a solution you are heating on the stirring hot plate. When the thermometer reading has stabilized, record the temperature readings given by both the thermometer and by the probe as indicated on the MIRAK display.

To calibrate the probe:

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Locate the logic board. (See illustration of interior of unit or the exploded view). Move the jumper from position J11 to position J1. For 100 and 120 volt units, you must remove jumper J3 if it exists.
3. Replace the bottom of the unit and turn the unit over.
4. Calculate the necessary correction for the probe using the following equation:  
Probe Error= (displayed temperature) - (actual temperature measured by other source)  
Correction= 350 - Probe Error (if the error is negative, the correction is >350)



### NOTE

The maximum error is  $\pm 10$ . Thus the correction must be between 340 and 360.

5. Turn the unit on. The display will show "888" and then "000". The HOT, PROBE, SET and TOP LED's will be on. Push the heat knob once. The digit on the far right side will get brighter.
6. Turn the heat knob clockwise until the display shows the correction calculated above. Push the heat knob again. The SET, TOP, and PROBE LED's will go out. The correction will remain on the display.
7. Unplug unit, turn unit upside down and remove screws from bottom. Move jumper J1 to one pin of J11. For 100 and 120 volt units, replace jumper J3 if necessary.
8. Replace the bottom of the unit.

## Using the Probe with the Temperature Display for Stirring-only Applications

On the stirring hot plate model, the probe can also be utilized to monitor the actual temperature of your solution when you want to stir the solution without heating. To use the probe without heating the solution, turn the knob until the display indicates "OFF" and press the knob to initiate operation. The element will not supply heat to the top plate. The display will indicate 'LO' if your solution temperature remains at less than 40°C, or the actual temperature of your solution if it is above 40°C.

## To Achieve Fast Heat-up of Large Volumes

**With a Probe** When heating large volumes of solution preheat the top plate at maximum temperature to allow the plate to heat the solution quickly before plugging your probe in to the probe receptacle in the back of the unit. As the top plate heats, monitor your solution temperature with a standard laboratory thermometer until your solution is approximately 15 degrees below your desired setpoint. Now plug your probe in to the unit, change the setpoint to your desired solution temperature, and place the probe in your solution.

**Without a Probe** If you are heating larger volumes and do not intend to use the probe to maintain a precise solution temperature, faster heating can be achieved by turning the heat control knob to maximum temperature until the solution starts to heat, and then turning the setpoint back to your desired top plate temperature.



### NOTE

If you allow the top plate to reach the maximum temperature of 540°C while preheating and then turn the control down to a setpoint less than 200°C, the temperature of the top will drop rapidly to 200°C. Because of the natural cooling characteristics of ceramic, the temperature of the top will drop much more gradually after the top plate temperature reaches 200°C.

## Heating Small Volumes

To heat small volumes quickly it should not be necessary to preheat the solution at a higher temperature. By not preheating small volumes you avoid the potential for the temperature to overshoot your desired setpoint. If you plan to control the solution temperature of a small volume sample with the probe, initiate heating with the probe in the solution; no preheating should be required.

## Heating Metal Vessels and Sand Baths

Metal vessels and sand baths cannot be heated on most solid ceramic tops because of the tendency for the metal and the sand to reflect heat back into the top, eventually exceeding the maximum temperature rating for a ceramic top, which causes it to break. Because the advanced electronic control in the MIRAK is capable of precisely regulating the top plate temperature, metal vessels and sand baths may be heated safely without the danger of the ceramic top breaking.

When heating metal vessels and sand baths however, we recommend that you DO NOT use the probe to control the temperature. Because of the heating and cooling properties of metal and sand, the sample temperatures fluctuate, which will result in unstable top plate temperatures. We achieved better results controlling the top plate temperature, which allowed us to maintain a constant level of heat to the sand bath or metal vessel. The top plate setpoint should be set approximately 100° above the temperature required for your sample, and the sample temperature may be monitored with a standard laboratory thermometer.

## Heat-up Time Guide

Unit	Temperature Setpoint	Flask Size	Amount of Solution	Time to Vigorous Boil
7" x 7" MIRAK	540°C	1 liter	1000 ml (water)	17 min.
7" x 7" MIRAK	540°C	2 liter	1800 ml (water)	19 min.
7" x 7" MIRAK	540°C	4 liter	4000 ml (water)	25 min.
12" x 12" 120 volt MIRAK	370°C	1 liter	1000 ml (water)	26 min.
12" x 12" 120 volt MIRAK	370°C	2 liter	1800 ml (water)	32 min.
12" x 12" 120 volt MIRAK	370°C	4 liter	4000 ml (water)	46 min.

12" x 12" 240 volt MIRAK	540°C	1 liter	1000 ml (water)	17 min.
12" x 12" 240 volt MIRAK	540°C	2 liter	1800 ml (water)	21 min.
12" x 12" 240 volt MIRAK	540°C	4 liter	4000 ml (water)	25 min.

Variability in heat-up times will be observed with different types of containers due to container shape and the thickness of the container wall. For temperature accuracy and stability information please refer to the Operating Specifications on page 13.

# Operating Specifications

**Top Plate Surface.....Solid Ceramic**

## Heating Specifications

Temperature range

All 7" x 7" models and the 208 and 240 volt models of the 12" x 12" models. 40°C to 540°C

100 and 120 volt 12" x 12" models. 40°C to 370°C

Heat-up time to maximum temperature (unloaded top plate). 8 minutes

Temperature stability at the center of the top plate surface (@ 70°C). ± 2.0°C

Stability of the solution temperature (400 ml of water in a 1000 ml glass flask).

Controlled by the top plate at 70°C setpoint (solution maintained at 30°C). ± 1.0°C

Controlled by the Barnstead|Thermolyne recommended immersion probe at 70°C setpoint (solution maintained at 70°C). ± 1.0°C

Accuracy of the temperature display vs the actual temperature at the center of the top plate (setpoint 70°C). (Top plate temperature was verified with an infrared camera mounted approx. 26" above the center of the top plate surface; temperature accuracy at the edges of the top plate may vary from the stated accuracy.) ± 4.0°C

Accuracy of the temperature display vs the actual solution temperature as measured by the stainless steel or Teflon® immersion probe (setpoint 70°C). ± 2.0°C

## Stirring Speed Specifications

Speed Range 60 to 1200 RPM

(Maximum speed is dependent on the viscosity of the solution)

Stability of the stirring speed setpoint (600 ml of water in a 1000 ml glass flask) ± 2.0 RPM

Accuracy of the speed display with the actual stirring speed ± 2.0 RPM

Top Plate Size	Max. Recommended Flask Size	Max. Weight on Top Plate
7" x 7"	4 liters	25 lbs
12" x 12"	6 liters	30 lbs

# General Operating Specifications

## Dimensions- 7" x 7" Models

Model Numbers	HP72620	SP72720	S72520
	HP72620-26	SP72720-26	S72520-26
	HP72624	SP72724	S72524
	HP72625	SP72725	S72525
Overall Width	8.250 (20.96)	8.250 (20.96)	8.250 (20.96)
Overall Height	5.750 (14.61)	5.750 (14.61)	5.50 (13.97)
Overall Depth	12.250 (31.12)	12.250 (31.12)	12.250 (31.12)
Top Plate Width	7.375 (18.73)	7.375 (18.73)	7.375 (18.73)
Top Plate Height	—	—	—
Top Plate Depth	7.375 (18.73)	7.375 (18.73)	7.375 (18.73)
Weight lbs. (kg)	8.44 (3.81)	10.33 (4.67)	9.25 (4.20)

## Dimensions- 12" x 12" Models

Model Numbers	HP72930	SP73030	
	HP72930-26	SP73030-26	
	HP72934	SP73034	S72830
	HP72935	SP73035	S72830-26
	HP72935-60	SP73035-60	S72834
	HP72938	SP73038	S72835
Overall Width	13.500 (34.29)	13.500 (34.29)	13.500 (34.29)
Overall Height	6.750 (17.15)	6.750 (17.15)	6.438 (16.35)
Overall Depth	16.625 (42.23)	16.625 (42.23)	16.625 (42.23)
Top Plate Width	12.375 (31.43)	12.375 (31.43)	12.375 (31.43)
Top Plate Height	—	—	—
Top Plate Depth	12.375 (31.43)	12.375 (31.43)	12.375 (31.43)
Weight lbs. (kg)	18.10 (8.21)	21.28 (9.65)	17.68 (8.02)

## Electrical Ratings- 7" x 7" Models

Model No.	Volts	Amps	Watts	Freq.	Phase
HP72620	240	4.6	1100	50/60	1
HP72620-26	230	4.6	1100	50/60	1
HP72624	100	11.0	1100	50/60	1
HP72625	120	9.2	1100	50/60	1
S72520	240	0.14	19.4	50/60	1
S72520-26	230	0.14	19.4	50/60	1
S72524	100	0.28	16.5	50/60	1
S72525	120	0.31	18.8	50/60	1
SP72720	240	4.7	1119	50/60	1
SP72720-26	230	4.7	1119	50/60	1
SP72724	100	11.3	1117	50/60	1
SP72725	120	9.5	1119	50/60	1

### Electrical Ratings- 12" x 12" Models

Model No.	Volts	Amps	Watts	Freq.	Phase
HP72930	220-240	12	3100	50/60	1
HP72930-26	220-240	12	3100	50/60	1
HP72934	100	16.5	1650	50/60	1
HP72935	120	13.5	1620	50/60	1
HP72935-60	120	13.5	1620	50/60	1
HP72938	208	13.9	2900	50/60	1
S72830	220-240	0.22	30	50/60	1
S72830-26	220-240	0.22	30	50/60	1
S72834	100	0.32	21	50/60	1
S72835	120	0.33	22	50/60	1
SP73030	220-240	12	3130	50/60	1
SP73030-26	220-240	12	3130	50/60	1
SP73034	100	16.8	1671	50/60	1
SP73035	120	13.8	1642	50/60	1
SP73035-60	120	13.8	1642	50/60	1
SP73038	208	14.1	2926	50/60	1

### Temperature Range for Hot Plates and Stirring Hot Plates

104°F - 1004°F (40°C - 540°C)

Exception: 100V & 120V 12"x 12" models — maximum temperature 698°F (370°C)

### Stirring Speed Range for Stirrers and Stirring Hot Plates

60 - 1200 rpm

### Environmental Parameters for all units

Ambient Temperature: 17°C - 27°C (63°F - 81°F) (Exception: stirrers. See Note.)

Relative Humidity: 20% - 80% (non-condensing)



#### NOTE

7" x 7" and 12" x 12" *stirrers* are suitable for use in a 37°C non-condensing incubator or in a cold room at -4°C



# Maintenance and Servicing



## WARNING

Disconnect from power supply before servicing.

Keep top surface clean. Use a non-abrasive cleaner. Alkali spills, hydrofluoric acid spills or phosphoric acid spills may damage top and lead to thermal failure. Unplug unit and remove spills promptly. Do not immerse unit for cleaning.

Replace the top immediately if damaged by etching, scratching or chipping. A damaged top can break in use.

Refer servicing to qualified personnel.

## Replacing the Power Board

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Locate power board at the back of the unit.
3. Note the position and color of wires and cable connected to the board.
4. Remove the wires and nuts.
5. Replace board and reconnect wires and cable as noted in step 3.
6. Replace the bottom and secure it with screws.

***Power board for hot plate detailing correct placement of wires and cables.***

***Power board for stirring hot plate detailing correct placement of wires and cables.***

***Power board for stirrer detailing correct placement of wires and cables.***

**Replacing the Logic Board**

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Locate logic board in the center of the unit.
3. Note the position and color of wires and cables connected to the board.
4. Remove the wires, cables and the 2 nuts on the mounting bracket.
5. Replace board and mount on bracket, adjusting the encoder wheel so that it freely rotates through the black slot (optical pickup) on the logic board. The black slot on the logic board should project no further than the holes in the outer perimeter of the encoder wheel.
6. Reconnect wires and cables as noted in step 3.
7. Proceed to Set-up Procedure.

**Replacing the Display Board**

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Locate display board behind the front panel of the unit.
3. Note the position of the blue stripe running along the bottom of the cable connected to the board.
4. Disconnect the cable from the board.
5. Loosen the nuts and remove board from front panel.
6. Replace board, reconnecting cable as noted in step 3. *Correct positioning of blue stripe on cable is important for proper functioning.*
7. Replace the bottom and secure it with screws.

**Replacing the Motor**

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Note position and color of wires and cables connected to the logic and display boards.
3. Remove logic board as described above.
4. Remove the wires and cable from the power board. (It is not necessary to remove the power board from the metal plate it is mounted to.)
5. Remove the display board as described above.
6. Remove encoder wheel from motor.

7. Remove the screws holding the top plate onto the case. (4 screws on 7" x 7" models, 6 screws on 12" x 12" models.) Remove the clamp holding the element lead down.
8. Flip top plate over.
9. Note the distance of the magnet assembly from the baffle plate.
10. Remove the magnet assembly.
11. Remove the two screws holding the motor and replace the motor.
12. Replace the magnet assembly.
13. Flip plate over, making sure thermocouple wire comes through the plate. Reinsert screws and tighten. (*Stirrers* do not have thermocouple wires.)
14. Replace encoder wheel. This will need adjusting in the next step.
15. Replace logic board. Adjust encoder wheel so that it freely rotates through slot (optical pickup) on logic board. The black slot on the logic board should project no further than the holes in the outer perimeter of the encoder wheel.
16. Reconnect wires as noted in step 2.
17. Replace the display board and reconnect wires as noted in step 2.
18. Replace bottom and secure with screws.

### Replacing the Top Plate Assembly

1. Unplug unit, turn unit upside down and remove screws from bottom.
2. Open unit. Note position and color of wires and cables connected to all three boards.
3. Remove logic board as described above.
4. Remove wires and cables from the power and display boards.
5. Remove the screws holding the metal plate onto the case. (4 screws on 7" x 7" models, 6 screws on 12" x 12" models.)
6. Remove metal plate and then unscrew top plate assembly.
7. Replace top plate assembly and reattach top plate assembly to the case.
8. Replace metal plate, making sure thermocouple and element wires come through metal plate. Then insert screws and tighten.
9. Replace logic board and mount on bracket. Adjust encoder wheel so that it freely rotates through slot (optical pickup) on logic board. The black slot on the logic board should project no further than the holes in the outer perimeter of the encoder wheel.
10. Reconnect wires and cables to all three boards as noted in step 2.
11. Proceed to Set-up Procedure.



#### NOTE

The set-up procedure should be followed whenever the top plate assembly or the logic board is replaced in your MIRAK hot plate or stirring hot plate. The set-up procedure is not necessary when replacing the top plate or the logic board in the stirrers.

## **Logic Printed Circuit Board**

### **Set-up Procedure**

1. Place a 500 ml flask with 300 ml of water on the top plate. Place a standard laboratory thermometer (do not use the probe for this procedure) 1/2" above the bottom of the flask.
2. Turn the unit on and set the temperature at 70°C. Allow the unit to operate at this temperature for five hours.
3. At the end of five hours, note the temperature measurement on the thermometer. (Ideally, the thermometer should read between 41°C and 47°C.) Subtract 44 degrees from the thermometer reading. (If your thermometer reading is greater than 44°C, your difference will be a negative number.) Record this difference; you may need to refer to it in step #9. If the difference is zero  $\pm 3$  your unit is within tolerance and you do not need to continue. If your difference exceeds zero  $\pm 3$  (i.e., if it is  $\pm 4$ ,  $\pm 5$ ,  $\pm 6$ , etc.) continue with steps 4 through 13. If this difference is greater than  $\pm 20$ , return the unit to Barnstead/Thermolyne for evaluation.
4. Turn the unit off, unplug the cordset from the power source, and allow the top plate to cool.
5. Once the top plate is cool, turn the unit over and remove the bottom cover. If your unit is a stirring hot plate you should also unscrew the logic board bracket from the metal plate at this time. (Refer to the instructions in this manual for disassembling and removing the logic board). On hot plate models you can easily access the logic board without removing the board from its position on the metal plate.
6. Locate the black plastic jumper on the logic board at position J11. (See the illustration on page 16). This black plastic jumper is secured on only one pin at that location. (Do not use the jumper located directly next to this jumper at position Jz3, which is secured by two pins). If the black plastic jumper is not at position J11 it may be located at position J1 on your model. Remove the jumper and secure it across both pins at position J1. If you cannot locate the jumper, contact Barnstead/Thermolyne.
7. Reattach the logic board bracket on your stirring hot plate model and realign the pickup slot with the encoder wheel (refer to the instructions in this manual for reassembling the logic board with the encoder wheel). Screw the bottom cover back on, plug the unit into the power source and turn the power switch to the ON position.



#### **NOTE**

The temperature display will read 888 and then 000. The PROBE, SET, TOP and HOT lights will all be illuminated.

8. Push the heat knob once. The digit on the far right side of the temperature display will get brighter. This display may read something other than zero. The HOT light may be on or off which indicates whether the number on the display is positive or negative. The number on the display is positive if the HOT light is on. If the HOT light is off the number on the display is negative.

9. Refer to the difference that you recorded in step #3. If that difference was greater than +3, turn the knob CLOCKWISE, counting each click of the knob until you have advanced the knob the same number of positions as the difference you calculated in step #3, *then turn the knob one additional click*. (The knob is detented so you can feel a click at each one degree position on the knob. Do not turn the knob a full rotation). If the difference you recorded in step #3 was less than -3, turn the knob COUNTERCLOCKWISE, counting each click of the knob until you have advanced the knob the same number of positions as the difference you calculated in step #3, *and then one additional click*.
10. Push the heat knob again. The PROBE, SET and TOP lights will no longer be illuminated.
11. Turn the power switch to the OFF position, unplug the cordset from the power source, and allow the top plate to cool completely.
12. Remove the bottom cover again and move the black plastic jumper on the logic board so it is attached to only one pin at position J1.
13. Replace the bottom again. The unit is now within tolerance and no further adjustment is necessary until the top plate assembly or the logic board is removed again.

### Troubleshooting Guide

Problem	Solution
Unit is not operating at all.	Check power. Replace circuit breaker on power switch.
Unit is stirring or heating, but no lights are lit on the display.	Check cable to the display board.
Only the power light is lit on the display.	Check ribbon cable connection from the power board to the logic board. It may be upside down. Replace display board.
Some digits of the display are not lit.	Replace display board.
Display does not increase or decrease when knob turned.	Check ribbon cable from knob to logic board. Replace ribbon cable from knob to logic board. Replace logic board. Replace encoder switch(es) on knob(s).
Speed or temperature display does not change when knob is pushed.	Check ribbon cable from knob to logic board. Replace logic board.
Unit does not stir.	Check to see if something is interfering with the motor preventing it from spinning. Replace power board or logic board. Replace motor.
Unit does not heat.	Check heating element. If resistance across element is greater than 100 $\Omega$ , replace element. Check connection of wires from element to power board. Check triac located on bottom cover of unit. Replace power board or logic board.
Display is reading erratic top plate temperature and/or the unit takes a long time to boil liquid without a probe.	Replace top plate assembly.
Display is reading erratic solution temperature.	Replace probe.

***Exploded View: Stirrers***

***Exploded View: Stir Plates***

***Exploded View: Hot Plates***



# Replacement Parts List

To insure your safety and for proper operation, the ceramic top plates for hot plates and stir plates are only sold as complete assemblies. This assembly includes the ceramic top, element, thermocouple, insulation, baffle plate, and 2 ceramic top holders.

Key Number	Part Number	Unit Size	Unit Voltage	Item Description
1	EL727X1B	7"	120V	Stir Plate or Hot Plate Top Assembly
	EL727X2B	7"	220-240V	Stir Plate or Hot Plate Top Assembly
	EL727X3B	7"	100V	Stir Plate or Hot Plate Top Assembly
	EL730X1B	12"	120V	Stir Plate or Hot Plate Top Assembly
	EL730X2B	12"	220-240V	Stir Plate or Hot Plate Top Assembly
	EL730X3B	12"	100V	Stir Plate or Hot Plate Top Assembly
	EL730X4B	12"	208V	Stir Plate or Hot Plate Top Assembly
	PT467X1	7"	100-240V	Stirrer Top Plate Only
	PT472X1	12"	100-240V	Stirrer Top Plate Only
2	CV727X2	7"	100-240V	Clear Plastic Cover
	CV730X2	12"	100-240V	Clear Plastic Cover
3	KB727X1A	7" & 12"	100-240V	"Heat" Knob for heating units
	KB727X2A	7" & 12"	100-240V	"Stir" Knob for stirring units
4	MT727X1A	7"	100-120V	Motor
	MT727X2A	7"	220-240V	Motor
	MT730X1A	12"	100-120V	Motor
	MT730X2A	12"	208-240V	Motor
5	<b>Display Printed Circuit Boards:</b> (Front of Unit)			
	PC725X4A	7" & 12"	100-240V	Stirrers
	PC726X1A	7" & 12"	100-240V	Hot Plates
	PC727X3A	7"	100-240V	Display PC Board Stir Plates
	PC730X1A	12"	100-240V	Display PC Board Stir Plates
6	<b>Logic Printed Circuit Boards:</b> (Center of Unit)			
	PC725X5A	7" & 12"	100-240V	Stirrers
	PC726X5A	7"	100-240V	Hot Plates
	PC727X2A	7"	100-240V	Stir Plates
	PC729X2A	12"	100-120V	Hot Plates
	PC730X4A	12"	100-120V	Stir Plates
	PC729X1A	12"	208-240V	Hot Plates
	PC730X2A	12"	208-240V	Stir Plates

7	<b>Power Supply Printed Circuit Boards: (Back of Unit)</b>			
	PC725X1A	7" & 12"	120V	Stirrers
	PC725X2A	7" & 12"	220-240V	Stirrers
	PC725X3A	7" & 12"	100V	Stirrers
	PC726X2A	7" & 12"	220-240V	Hot Plates
	PC726X3A	7" & 12"	100V	Hot Plates
	PC726X4A	7" & 12"	120V	Hot Plates
	PC727X1A	7" & 12"	120V	Stir Plates
	PC727X4A	7" & 12"	100V	Stir Plates
	PC727X5A	7" & 12"	220-240V	Stir Plates
	PC730X3A	12"	208V	Stir Plates & Hot Plates
Not listed on exploded view	<b>Additional Replacement Parts</b>			
	<b>Part Number</b>	<b>Unit Size</b>	<b>Unit Voltage</b>	<b>Item Description</b>
	SWX140	7" & 12"	100-240V	Front Switch
	SWX104	7" & 12"	100-240V	Circuit Breaker Switch Stirrers
	SWX141	7" & 12"	100-240V	Circuit Breaker Switch Hot Plates and Stir Plates.
	<b>Accessory Thermocouple Probes: (Used with all voltages)</b>			
	TC727X2	7.874" Sheath	Teflon	For corrosive solutions
	TC732X1	6.000" Sheath	Stainless Steel	For general purpose use
	TC732X2	10.000" Sheath	Stainless Steel	For general purpose use

## Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the **Barnstead|Thermolyne** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 319-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead |Thermolyne Corp.**, please contact our Customer Service Department for a "Return Goods Authorization" number (RGA). Material returned without a RGA number will be refused.

## **Barnstead|Thermolyne One Year Limited Warranty**

**Barnstead|Thermolyne Corporation** warrants that if a product manufactured by **Barnstead|Thermolyne** and sold by it within the continental United States or Canada proves to be defective in material or construction, **Barnstead|Thermolyne** will provide you, without charge, for a period of ninety (90) days, the labor, and a period of one (1) year, the parts, necessary to remedy any such defect. Outside the continental United States and Canada, the warranty provides, for one (1) year, the parts necessary to remedy any such defect. The warranty period shall commence either six (6) months following the date the product is sold by **Barnstead|Thermolyne** or on the date it is purchased by the original retail consumer, whichever date occurs first.

All warranty inspections and repairs must be performed by and parts obtained from an authorized **Barnstead|Thermolyne** dealer or **Barnstead|Thermolyne** (at its own discretion). Heating elements, however, because of their susceptibility to overheating and contamination, must be returned to our factory, and if, upon inspection, it is concluded that failure is not due to excessive high temperature or contamination, warranty replacement will be provided by **Barnstead|Thermolyne**. The name of the authorized **Barnstead|Thermolyne** dealer nearest you may be obtained by calling 1-800-446-6060 or writing to:

**Barnstead|Thermolyne**  
P.O. Box 797  
2555 Kerper Boulevard  
Dubuque, IA 52004-0797  
USA  
FAX: (319) 556-0516

E-MAIL ADDRESS: [mkt@barnstead.com](mailto:mkt@barnstead.com)

**Barnstead|Thermolyne's** sole obligation with respect to its product shall be to repair or (at its own discretion) replace the product. Under no circumstances shall it be liable for incidental or consequential damage.

THE WARRANTY STATED HEREIN IS THE SOLE WARRANTY APPLICABLE TO **BARNSTEAD|THERMOLYNE** PRODUCTS. **BARNSTEAD|THERMOLYNE** EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE.